[0022] In an embodiment, the CAR further comprises one or more costimulatory signaling domains, and wherein the first and/or second nucleic acid sequence comprises DNA or cDNA.

[0023] In an embodiment, the first and/or second nucleic acid sequence comprises a vector. In an embodiment, the vector is a viral vector. In an embodiment, the viral vector is a retroviral vector or a lentiviral vector. In an embodiment, the T cell is virally transduced to express the first and/or second nucleic acid sequence.

[0024] In an embodiment, the extracellular domain of the CAR comprises an antigen-binding domain. In an embodiment, the antigen-binding domain is a scFv domain.

[0025] In an embodiment, the transmembrane domain comprises the transmembrane portion of a protein selected from the group consisting of the alpha, beta or zeta chain of the T-cell receptor, CD28, CD3 epsilon, CD45, CD4, CD5, CD8, CD9, CD16, CD22, CD33, CD37, CD64, CD80, CD86, CD134, CD137 and CD154.

[0026] In an embodiment, the intracellular signaling domain comprises a functional signaling domain of CD3 zeta, common FcR gamma (FCER1G), Fc gamma RIIa, FcR beta (Fc Epsilon R1b), CD3 gamma, CD3 delta, CD3 epsilon, CD79a, CD79b, DAP10, and DAP12.

[0027] In an embodiment, the extracellular domain is connected to the transmembrane domain by a hinge region.

[0028] In an embodiment, the CAR further comprises one or more costimulatory signaling domains. In an embodiment, the costimulatory signaling domain is a functional signaling domain from a protein selected from the group consisting of OX40, CD27, CD28, CD30, CD40, PD-1, CD2, CD7, CD258, NKG2C, B7-H3, a ligand that binds to CD83, ICAM-1, LFA-1 (CD11a/CD18), ICOS and 4-1BB (CD137), or any combination thereof.

[0029] In an embodiment, the polypeptide which enhances T cell priming (ETP) is selected from the group consisting of a costimulatory molecule, a soluble cytokine, a polypeptide involved in antigen presentation, a polypeptide involved in trafficking and/or migration, or a polypeptide involved in dendritic cell targeting, or a functional fragment or variant thereof. In an embodiment, the costimulatory molecule ETP is selected from the group consisting of CD70, CD83, CD80, CD86, CD40, CD154, CD137L (4-1BBL), CD252 (OX40L), CD275 (ICOS-L), CD54 (ICAM-1), CD49a, CD43, CD48, CD 112 (PVRL2), CD150 (SLAM), CD155 (PVR), CD265 (RANK), CD270 (HVEM), TL1A, CD127, IL-4R, GITR-L, CD160, CD258, TIM-4, CD153 (CD30L), CD200R (OX2R), CD44, ligands thereof, and functional fragments and variants thereof. In an embodiment, the soluble cytokine is selected from the group consisting of: IL-2, IL-12, IL-6, IL-7, IL-15, IL-18, IL-21, GM-CSF, IL-18, IL-21, IL-27, and functional fragments and variants thereof. In an embodiment, the polypeptide involved in antigen presentation is selected from the group consisting of CD64, MHC I, MHC II, and functional fragments and variants thereof. In an embodiment, the polypeptide involved in trafficking and/or migration is selected from the group consisting of CD183, CCR2, CCR6, CD50, CD197, CD58, CD62L, and functional fragments and variants thereof. In an embodiment, the polypeptide involved in DC targeting is selected from the group consisting of TLR ligands, anti-DEC-205 antibody, an anti-DC-SIGN antibody, and functional fragments and variants thereof.

[0030] In an embodiment, the antigen-binding domain binds to an antigen associated with a disease state. In an embodiment, the disease state is selected from the group consisting of a proliferative disease, a precancerous condition, a non-cancer indication, a viral infection, and a bacterial infection. In an embodiment, the antigen-binding domain binds to a tumor antigen, a viral antigen, or a bacterial antigen. In an embodiment, the tumor antigen is an antigen associated with a cancer selected from the group consisting of brain cancer, bladder cancer, breast cancer, cervical cancer, colorectal cancer, liver cancer, kidney cancer, lymphoma, leukemia, lung cancer, melanoma, metastatic melanoma, mesothelioma, neuroblastoma, ovarian cancer, prostate cancer, pancreatic cancer, renal cancer, skin cancer, thymoma, sarcoma, non-Hodgkin's lymphoma, Hodgkin's lymphoma, uterine cancer, and combinations thereof.

[0031] In an embodiment, the T cell described herein has enhanced antigen presentation ability relative to a T cell which lacks the second nucleic acid sequence.

[0032] In an embodiment, the T cell described herein has enhanced T cell priming ability relative to a T cell which lacks the second nucleic acid sequence.

[0033] In an embodiment, the T cell is transfected to transiently express a nucleic acid comprising a third nucleic acid sequence encoding a polypeptide which enhances T cell priming, or a functional fragment or variant thereof, which differs from the polypeptide encoded by the second nucleic acid sequence. In an embodiment, the T cell has increased T cell priming ability relative to a T cell comprising the first nucleic acid sequence and second nucleic acid sequence, but not the third nucleic acid sequence. In an embodiment, the third nucleic acid sequence comprises an RNA. In an embodiment, the T cell is transfected to transiently express the third RNA. In an embodiment, the cell does not comprise an exogenous DNA encoding the third RNA. In an embodiment, the CAR comprises one or more costimulatory signaling domains, and wherein the third nucleic acid sequence comprises DNA. In an embodiment, the T cell further comprises one or more additional distinct nucleic acid sequences encoding a polypeptide which enhances T cell priming, or a functional fragment or variant thereof, which differ from the polypeptides encoded by the second and third nucleic acid sequences. In an embodiment, the one or more additional nucleic acid sequences comprises RNA. In an embodiment, the CAR comprises one or more costimulatory signaling domains, and wherein the one or more additional nucleic acids comprise DNA. In an embodiment, the first, second, and/or additional nucleic acid sequences are transcribed from one or more in vitro transcription vectors.

[0034] In an embodiment, expression of the polypeptide encoded by the second and/or additional nucleic acid sequences does not substantially affect, e.g., decrease, reduce, or inhibit, the cell-killing function of the CAR encoded by the first nucleic acid sequence.

[0035] In an embodiment, the T cell has increased efficacy in killing tumor cells or reducing tumor size in a subject with a tumor relative to a T cell comprising only the CAR encoded by the first nucleic acid sequence.

[0036] In an embodiment, the T cell enhances the priming of T cells with a tumor antigen, a viral antigen, a bacterial antigen.

[0037] In an embodiment, the T cells described herein are made by introducing a nucleic acid wherein (a) the nucleic